

Hidden in Plain Sight: Masculine Social Norms in Engineering Education

Usenime M. Akpanudo¹, James L. Huff², &
Jenise K. Williams^{2, 3}

Canon-Clary College of Education¹
Department of Engineering and Physics²
Department of Art and Design³
Harding University
Searcy, Arkansas, USA

Allison Godwin
School of Engineering Education
Purdue University
West Lafayette, Indiana, USA

Abstract—In this work-in-progress paper, we synthesize research from psychology, sociology, and engineering education, in order to consider the presence of masculine social norms in engineering. According to prior work, social norms represent collective expectations that are socially constructed by majority social groups about the proper role and conduct of different groups in society. Social norms related to masculinity are often associated with emotional regulation, the exertion of significant dominance over others, and the desire to win. Unfortunately, the social pressure to conform to traditional ideologies of masculinity has been shown to adversely affect individual's help seeking behaviors, sexual health, and self-esteem. In the interest of gaining a better understanding and promoting inclusivity in the culture of engineering degree programs, we explore in this paper how these collective expectations may be particularly relevant in the context of engineering – a field often critiqued as being governed by masculine norms.

Keywords- masculinity; social norms; inclusion; belonging

I. INTRODUCTION

There's three girls in our whole office (laugh). So, it's pretty much all guys. I honestly think it helps [the office culture] because—you know, the guys can pretty much talk about anything and, um--there's no, like, sexual divide or anything like that; it's everybody just talking to talk and there's not really any drama or anything like that, so--makes it easy. . . I think they're [female colleagues are] fine with it. You know, they just—or at least the way I see it is—they just see themselves as another engineer, and the fact they're a girl doesn't really make a difference. (Andrew [pseudonym], an early-career engineer)

In this excerpt from an interview transcript in our previous work on engineering identity [1-2] Andrew depicts a subtle yet powerful phenomenon that we contend is pervasive in engineering education and industry. Andrew, a White male, describes his experience of being a member of the dominant gender group in his workplace (“it’s pretty much all guys”). More specifically, he suggests that his experience as a male engineer establishes a sense of normality where the perceived cultural boundaries between engineering and masculinity are fuzzy. According to Andrew, he is a part of an effective

workplace, in part, because of the dominant presence of male engineers (“makes it easy”). He notes that the conversation patterns reflect documented masculine patterns of appearing to be emotionally regulated (“not really any drama”). And while he seems to recognize the ease that male engineers have in reconciling the gender and professional identities, he appears blind to the possible difficulties of his female colleagues (“they just see themselves as another engineer”).

In this work-in-progress paper, we critically examine literature from psychology and sociology in order to consider the presence of social norms related to masculinity in engineering. This exploration of literature reflects our early work in our larger investigation that seeks to critically examine how masculinity is enacted and experienced in engineering contexts. Existing engineering education research has often explored the topic of inclusion of women and people of color within institutional structures of engineering education and practice. Much of this research has focused on unpacking the particular trajectories of marginalized individuals within the current culture and structures of engineering [3-6]. Through these studies, we have gained insight into the systemic forces of engineering institutions that work against the inclusion of people that do not belong to the overrepresented White, male social group.

Yet, while it is well-documented that engineering institutional contexts are marked by a masculine culture that marginalizes those who do not belong to the majority group, there is a gap in understanding precisely how engineering cultures are connected to masculinity. The goal of our overall investigation is to critically examine the ubiquitous yet hidden connections between social norms regarding masculinity and the process of professional formation in engineering education. The research questions that frame our investigation are as follows:

- RQ1: Is there a relationship between different masculine performances and belongingness in engineering?
- RQ2: How do students experience masculinity in engineering context?

We contend that specific cultural values related to the selection of candidates and the training of engineers account

for masculine social norms. Specifically, we make the case that norms, such as those associated with traditional ideas of masculinity are dominant in the education of engineers. These norms serve as both incentives and disincentives to future engineers and ultimately affect to a great degree whether candidates persist, and are successful in the field and form a functional identity of themselves as engineers. Furthermore, we explore how specific demographic characteristics may color individual awareness of, subscription to, or accommodation of these dominant norms.

We begin by reviewing the extant literature in psychology and sociology regarding social norms related to masculinity. Then, we examine the literature on social norms in STEM education and engineering education. We then draw on this literature as a robust foundation of knowledge that will enable us ultimately explore this phenomenon more precisely to address our research questions.

In conclusion, we will comment on how masculinity may affect engineering culture and identify the initial steps of our ongoing work to understand how the social norms related to masculinity can influence the recruitment, socialization, and inclusion of future engineers. The results of this review will provide implications for engineering educators and researchers on how particular practices and norms may prove exclusionary to non-dominant groups in engineering and highlight leverage points in engineering culture that can be shifted to make engineering an environment where all students are welcome.

II. LITERATURE REVIEW OF MASCULINE SOCIAL NORMS IN PSYCHOLOGY AND SOCIOLOGY

According to prior work [7-10], social norms represent socially constructed expectations communicated by dominant groups in society about the proper role and conduct of different groups in society. Some norms are explicitly expressed and easy to identify while others are less explicit and are expressed in ways that are more nuanced. As Cialdini and Trost put it, social norms are ultimately about constraining individual behavior to acceptable patterns understood by members of the social group without necessarily resorting to the force of law [11].

Social norm theory originally conceived by Perkins and Berkowitz [12] has been extensively used in psychology, behavioral health, and counseling to explain the efficacy of perceptions or misperceptions about the behavior of others in social settings to influence individual behavior. Hillenbrand-Gunn, et al, for instance, showed that controlling perceptions related to social norms regarding rape, significantly impacted high school males' view of what they would do in situations where women were vulnerable to sexual assault [13]. Beatty, Syzdek and Bakkum [14] also showed that when men's perceptions of their peer's stereotypical gender role behaviors go unchallenged, it serves to reinforce such perceptions. Our review of the social norms literature hones in specifically on its intersection with the gender role norms regarding masculinity. Similar to other social norms, gender role

norms related to masculinity work to influence individual behavior in relation to acceptable conduct for those occupying the male space. We hold that norms regarding what it means to be "manly," are enacted in plain sight in the field of engineering but are treated as invisible and go largely unchallenged. According to social norm theory, this combination of circumstances only serves to reinforce the idea of such values and perceptions being normal.

As we elaborate in this section, we show that psychologists and sociologists interested in critical theory have conducted research to peel back the cloak that renders the characteristics of masculinity invisible or "unmarked" in the social landscape. These studies challenge many of the norms we take for granted about gender role and power relations in an attempt to draw attention not only to these inequities but also to the consequences of such arrangements. It is not surprising, therefore, that traditional psychological and sociological ways of framing masculinity are fraught with emphasis on archetypal aspects of unquestioned assumptions about male dominance.

This is because traditional ideas of masculinity have been constructed primarily from the lens of male social dominance. A dominance that involves the elevation to a status of normal those roles and activities that men are best positioned to perform. In this way, masculinity has been described as a hierarchy of social values which favors masculine roles over all others. Connell & Messerschmidt [15] aptly captured the coalescing of these ideas and concepts into what came to be known as hegemonic masculinity. As they explain:

It [hegemonic masculinity] embodied the currently most honored way of being a man, and required all other men to position themselves in relation to it. Men who received benefits of patriarchy without enacting a strong version of masculine dominance could be regarded as showing a "complicit" masculinity.... Hegemony did not mean violence, although it could be supported by force; it meant ascendancy achieved through culture, institutions, and persuasion. (p. 3).

In other words, hegemonic masculinity describes accepted practices that legitimize men's dominant position in society and justifies the subordination of women and other marginalized ways of being a man. Consequently, traditional social norms regarding masculinity are associated with gendered expectations about behavior, such as the desire to win, emotional regulation, the exertion of significant dominance over others, and men's power over women [9].

Several attempts have been made at operationalizing social norms regarding masculinity, each effort focusing on a slightly different aspects of the phenomenon. Mahalik et al.'s Conformity to Masculine Norms Inventory (CMNI) [9] for instance included measures drawing heavily from

traditional norms regarding masculinity, while Eisler and Skidmore [16] focused on gender role stress. Similarly, Levant et al [17-18] emphasized masculinity ideology using their Male Role Norm Inventory (MRNI). Others like Bem [19] recognized androgyny as an important dimension on the masculinity-femininity continuum; or considered accessing men's subjective experiences of masculinity a more accurate way of framing the phenomenon [20].

One potentially negative social impact of hegemonic masculinity is that patterns of behavior that ordinarily would be considered harmful and detrimental in social settings can become acceptable once wrapped in the cloak of masculinity. For instance, the social pressure to conform to traditional ideologies of masculinity has been shown to adversely affect the help-seeking behaviors, sexual health, and self-esteem of men [21-22]. Likewise, Courtenay notes that although men in the United States are at higher risk of suffering from severe chronic disease, they are also more likely to engage in behaviors that increase these risks [23]. Interestingly, one of the defining characteristics of hegemonic masculinity is demonstrating a sense of invincibility and risk-taking [22] ideals which may run counter to personal well-being, but which are socially rewarded with dominance and power [23].

Also important to this discussion are the negative outcomes that result when individual identities do not line up with social expectations of gendered roles. For instance, there are negative consequences for young men or women in social settings where there is great pressure to conform to unrealistic ideals of what it means to occupy the male space. Whereas traditional hegemonic ideas of masculinity have focused on distilling the essentials of masculinity scripts, many authors agree that such ideals only account for the experiences of a very limited number of men; and recognize the meaningfulness of viewing masculine hierarchies as a plurality. Recognizing that apart from the atavistic concepts of what masculinity entails, that there exist other manifestations of the male gendered experience that are equally as legitimate.

It is also worth noting that the values associated hegemonic masculine ideals are not static, but continually evolve, varying by setting and location [24-25]. However, one feature of this process appears constant; these ideals ultimately, always take on a form in which much of what is considered worthy or valuable is designated as masculine. Anderson points out a great example of these traditional ideals of masculinity being enacted in a setting that is not normally associated with male dominance. He noted, for instance, that male cheerleaders recognize their sport as being traditionally feminine. Yet at the same time, they see themselves as no different from traditional males. Male cheerleaders, therefore, project their masculinity by delineating their roles within the cheerleading squad to those that are considered masculine in an orthodox sense [26].

We believe that a well-informed understanding of masculine social norms is particularly relevant in the context of engineering – a field often critiqued as being governed by masculine norms. Prior work confirms, for example, the importance of female students' subject-related identities and agency beliefs in explaining engineering career choice [27]. An examination of the experience of those engineering students who do not identify strongly with the dominant social norms in the field would add to our understanding of the engineering education. Furthermore, given that, "...on average, hypothetical successful students in engineering institutions were rated significantly more masculine, and significantly less feminine, than were other successful students at liberal arts institution" [28] (p. 39), there is clearly a need to further investigate this phenomenon.

III. LITERATURE REVIEW OF MASCULINITY IN STEM AND ENGINEERING CONTEXTS

With some exception, extant research on masculinity in the context of engineering education tends to focus on how structural forces within the field serve to marginalize women while also reinforcing male privilege [29]. For example, through her archival research on engineering periodicals at the turn of the twentieth century, Frehill [30] illustrated how engineering was historically framed as a profession that excluded participation of women, promoted dominant images of masculinity to attract young boys to engineering (e.g., affinity for sports and the outdoors), and became an occupational space for "proving manhood" (p. 392). While this sociohistorical lens of the engineering profession depicts an overt connection to dominant views of masculinity, more recent ethnographic studies reveal poignant yet subtle forms of hegemonic masculinity in that pervade the culture of engineering—both in degree programs [31] and in the workplace [32-34]. More specifically, these studies highlight how women describe a need to be high performing engineers in order to be accepted engineers while men may be recognized as engineers with a mediocre performance in their role. Women feel an invisibility as engineers but also a high visibility as females.

This continued pattern of masculinity in the engineering profession is somewhat of an anomaly when compared to other disciplines in STEM. While most professional cultures in STEM were also historically framed as masculine domains, many of these disciplines have made significant strides over the last three decades in the number of women enrolled in degree programs. Biology, chemistry, and mathematics all have close to or above 50% female enrollment in bachelor's degree programs [35]. However, physics and engineering along with computer science have trailed dismally behind. Both physics and engineering have stagnated at approximately 20% female enrollment in bachelor's degree programs over the last 20 years [35-36]. Many women do not see engineering or physics as "for them" [37].

Further exploration uncovered that students view these subjects as "quintessentially masculine" [38] (p. 156). In a qualitative study with 132, 15-16-year-old youth and their

parents in the United Kingdom, Francis and colleagues [38] found that one major discourse about women in physics and engineering highlights underlying masculine characteristics. In particular, students in the study often referred to the popular show “The Big Bang Theory” as an illustrative example of how all the men were physicists or a lowly engineer, and one of the main characters, Penny, was “the one that isn’t smart, because she’s a girl and she’s interested in girl things....but it’s just sexist.”

In sum, the reviewed research in social sciences and education has revealed a compelling picture of how the engineering profession perpetuates a culture of hegemonic masculinity. Yet all of the investigations that we have discussed are characterized by how this culture serves to uphold male privilege while marginalizing those who do not align with the dominant image. As discussed in the previous literature review, psychological and sociological literature illustrates how social constructions and individual experiences of masculinity are more complex than the disturbing patterns of hegemony. We authors are aware of one investigation by Simon and colleagues [39] which uses the Bem sex-role inventory [19] connects occupational values in STEM students to values related to masculinity and femininity. They found that STEM majors tend to reward masculine values and that women (and not men) tend to be marginalized from the major if they uphold feminine qualities. While their investigation was original in its connection of psychological theories of masculinity/femininity with occupational values of STEM majors, they did not examine engineering specifically. Moreover, unlike the previous qualitative studies discussed in this section, they did not capture the complexity of individual’s experiences with masculinity in their fields.

Thus in our investigation, we intend to employ quantitative and qualitative research methods to data gathered from a national sample of engineering student using existing measures of masculinity. In so doing, we hope to fill the gap in our knowledge of masculinity in engineering contexts; and gain a comprehensive picture of how perceived masculine social norms are connected to belonging in engineering (RQ1) and how individuals experience these social norms as they participate in the engineering profession (RQ2).

IV. FUTURE DIRECTIONS

The previous sections demonstrate why our research questions concerning masculinity in the context of engineering institutions are theoretically relevant. However, as engineering education researchers, we must ask ourselves the question of how the findings of our investigation could lead to needed revolutionization of our professional cultures. First, we contend that in order to transform the hegemonic masculine social norms that characterize engineering, we must generate a comprehensive understanding of how masculinity is enacted in engineering schools and workplaces. Although previous research has highlighted the tendency of masculine cultures to marginalize women in the field, we must also ask how seemingly harmless masculine norms might contribute to hegemonic cultures. Additionally, by using well-established psychological research to name perceived masculine norms of

engineering, we could also identify how cultures of engineering can lead to maladaptive professional strategies (e.g., not seeking help in order to promote self-reliance, inability to process difficult emotions [22]). In conclusion, if we want to better promote inclusion of those who are marginalized by engineering cultures, we must first generate a detailed understanding of why some members *do* experience inclusion.

REFERENCES

- [1] J. L. Huff, J. A. Smith, B. K. Jesiek, C. B. Zoltowski, W. B. Graziano, & W. C. Oakes, “From methods to methodology: Reflection on keeping the philosophical commitments of interpretative phenomenological analysis,” in *ASEE/IEEE Frontiers in Education Conference*, Madrid, 2014, pp. 1622-1630..
- [2] J. L. Huff, B. K. Jesiek, W. C. Oakes, C. B. Zoltowski, K. D. Ramane, & W. G. Graziano. “Tensions of integration in professional formation: Investigating development of engineering students’ social and technical perceptions,” in *ASEE Annual Conference*, Seattle, WA, 2015, pp. 26.1501.1 - 26.1501.5.
- [3] E. Godfrey, & L. Parker. “Mapping the cultural landscape in engineering education.” *J. of Eng. Educ.*, vol 99, no. 1, pp. 5-22, 2010.
- [4] A. L. Pawley, “‘Learning from small numbers’ of underrepresented students’ stories: Discussing a method to learn about institutional structure through narrative.” in *ASEE Annual Conference & Exposition*, Atlanta, Georgia, 2013, pp. 23.1405.1 - 23.1405.21.
- [5] W. Faulkner, “‘Nuts and Bolts and People’: Gender-troubled engineering identities.” *Social Studies of Science*, vol. 37, no. 3, pp. 331–356, 2007.
- [6] E. A. Cech. “Culture of disengagement in engineering education?” *Science, Technology, & Human Values*, vol. 39, no. 1, pp. 42-72, 2014.
- [7] A. D. Berkowitz. “Applications of social norms theory to other health and social justice issues,” in *The Social Norms Approach to Preventing School and College Age Substance Abuse: A Handbook for Educators, Counselors, and Clinicians*, H.W. Perkins, Ed., San Francisco, CA: Jossey-Bass, 2003, pp. 259-279.
- [8] T. L. Hillenbrand-Gunn, M. J. Heppner, P. A. Mauch, & H. J. Park. “Men as allies: The efficacy of a high school rape prevention intervention.” *J. of Counseling & Development*, vol. 88, no. 1, pp. 43-51, 2010.
- [9] J. R. Mahalik, B. D. Locke, L. H. Ludlow, M. A. Diemer, R. P. Scott, M. Gottfried, & G. Freitas. “Development of the Conformity to Masculine Norms Inventory.” *Psychology of Men & Masculinity*, vol. 4, no. 1, pp. 3-25, 2003.
- [10] S. McMahon, & A. Dick. “‘Being in a room with like-minded men’: An exploratory study of men’s participation in a bystander intervention program to prevent intimate partner violence.” *J. of Men’s Studies*, vol. 19, no. 1, pp. 3-18, 2011.
- [11] R. B. Cialdini, & M. R. Trost. “Social influence: Social norms, conformity and compliance,” in *The Handbook of Social Psychology*, Vol. 2, D. Gilbert, S. Fiske, & G. Lindzey, Eds., Boston, MA: McGraw-Hill, 1998, pp. 151-192.
- [12] H. W. Perkins, & A. D. Berkowitz. “Perceiving the community norms of alcohol use among students: Some research implications for campus alcohol education programming.” *Int. J. of the Addictions*, vol. 21, nos. 9-10, pp. 961-976, 1986.
- [13] T. L. Hillenbrand-Gunn, M. J. Heppner, P. A. Mauch, & H. J. Park. “Men as allies: The efficacy of a high school rape prevention intervention.” *J. of Counseling & Development*, vol. 88, no. 1, pp. 43-51, 2010.
- [14] A. Beatty, M. Syzdek, & A. Bakkum. “The Saint John’s experience project: Challenging men’s perceptions of normative gender role conflict.” *J. of Men’s Studies*, vol. 14, no. 3, pp. 322-336, 2007.
- [15] R. W. Connell, & J. W. Messerschmidt. “Hegemonic masculinity rethinking the concept.” *Gender & society*, vol. 19, no. 6, pp. 829-859, 2005.

- [16] R. M. Eisler, & J. R. Skidmore. "Masculine gender role stress: Scale development and component factors in the appraisal of stressful situations." *Behavior modification*, vol. 11, no. 2, pp. 123-136, 1987.
- [17] R. F. Levant, L. Hirsch, E. Celentano, T. Cozza, S. Hill, & M. MacEachern. "The male role: An investigation of norms and stereotypes." *J. of Mental Health Counseling*, vol. 14, pp. 325-337, 1992.
- [18] R. F. Levant, & J. Fischer. "The male role norms inventory," in *Sexuality-Related Measures: A Compendium (2nd ed.)*, C.M. Davis, W. H. Yarber, R. Bauserman, G. Schreer, & S. L. Davis (Eds.), Newbury Park, CA: Sage, 1998, pp. 469-472.
- [19] S. L. Bem. "The measurement of psychological androgyny," *J. of Consulting and Clinical Psychology*, vol. 42, no. 2, pp. 155-162, 1974.
- [20] Y. J. Wong, M. Shea, J. R. LaFollette, S. J. Hickman, N. Cruz, & R. Boghokian. "The inventory of subjective masculinity experiences: Development and psychometric properties." *J. of Men's Studies*, vol. 19, no. 3, pp. 236-255, 2011.
- [21] R. F. Levant, & D. J. Wimer. "The relationship between conformity to masculine norms and men's health behaviors: testing a multiple mediator model." *Intl. J. of Men's Health*, vol. 13, no. 1, pp. 22-41, 2014.
- [22] J. R. Mahalik, G. E. Good, & M. Englar-Carlson. "Masculinity scripts, presenting concerns, and help seeking: Implications for practice and training." *Professional Psychology: Research and Practice*, vol. 34, no. 2, pp. 123-131, 2003.
- [23] W. H. Courtenay. "Constructions of masculinity and their influence on men's well-being: a theory of gender and health." *Social Science & Medicine*, vol. 50, no. 10, pp. 1385-1401, 2000.
- [24] C. A. MacKinnon *Feminism Unmodified: Discourses on Life and Law*. Cambridge, MA: Harvard University Press, 1987.
- [25] W. D. Imms. "Multiple masculinities and the schooling of boys." *Canadian J. of Educ./Revue canadienne de l'education*, vol. 25, no. 2, pp. 152-165, 2000.
- [26] E. Anderson. "Orthodox and inclusive masculinity: Competing masculinities among heterosexual men in a feminized terrain." *Sociological Perspectives*, vol. 48, no. 3, pp. 337-355, 2005.
- [27] A. Godwin, G. Potvin, Z. Hazari, & R. Lock. "Identity, critical agency, and engineering: An affective model for predicting engineering as a career choice." *J. of Eng. Educ.*, vol. 105, no. 2, pp. 312-340, 2016.
- [28] E. De Pillis, & L. De Pillis. "Are engineering schools masculine and authoritarian? The mission statements say yes." *J. of Diversity in Higher Educ.*, vol. 1, no. 1, pp. 33-44, 2008.
- [29] J. Acker. "Hierarchies, jobs, bodies: A theory of gendered organizations." *Gender & Society*, vol. 4, no. 2, pp. 139-158, 1990.
- [30] L. M. Frehill. "The gendered construction of the engineering profession in the United States, 1893-1920." *Men and Masculinities*, vol. 6, no. 4, pp. 383-403, 2004.
- [31] K. L. Tonso. "Teams that work: Campus culture, engineer identity, and social interactions." *J. of Eng. Educ.*, vol. 95, no. 1, pp. 1-13, 2006.
- [32] D. L. Collinson. "Engineering humour: Masculinity, joking and conflict in shop-floor relations." *Organization Studies*, vol. 9, no. 2, pp. 181-199, 1988.
- [33] W. Faulkner. "The power and the pleasure? A research agenda for 'making gender stick' to engineers." *Science, Technology, & Human Values*, vol. 25, no. 1, pp. 87-119, 2000.
- [34] W. Faulkner. "Doing gender in engineering workplace cultures. II. Gender in/authenticity and the in/visibility paradox." *Engineering Studies*, vol. 1, no. 3, pp. 169-189, 2009.
- [35] U.S. Department of Education. National Center for Education Statistics; 2013, "Digest of Education Statistics (NCES 2015-011)," 2015.
- [36] B. L. Yoder, "Engineering by the Numbers," in American Society for Engineering Education, 2015.
- [37] L. Archer, J. DeWitt, J. Osborne, J. Dillon, B. Willis, & B. Wong, "'Not girly, not sexy, not glamorous': primary school girls' and parents' constructions of science aspirations" *Pedagogy, Culture & Society*, vol. 21, no. 1, pp. 171-194, 2012.
- [38] B. Francis, L. Archer, J. Moote, J. DeWitt, E. MacLeod, & L. Yeomans. "The construction of physics as a quintessentially masculine subject: Young people's perceptions of gender issues in access to physics." *Sex Roles*, vol. 76, no. 3, pp. 156-174, 2016.
- [39] R. M. Simon, A. Wagner, & B. Killion. "Gender and choosing a STEM major in college: Femininity, masculinity, chilly climate, and occupational values." *J. of Research in Sci. Teaching*, vol. 54, no. 3, pp. 299-323, 2016.